THE RECORD

OF THE

UNITED STATES NAVAL INSTITUTE.

Vol. II. 1876. No. 6.

U. S. NAVAL ACADEMY, ANNAPOLIS,

OCTOBER 12, 1876.

Professor CHA'S E. MUNROE in the Chair.

The Secretary read the following paper.

HYGIENIC NOTES ON SHIPS' BILGES.

BY LIEUT. COM. CHARLES F. GOODRICH.

I.

It is an unquestioned fact that, in the internal arrangements of our ships at war, naval constructors have been pre-eminently conservative.

Whatever of new and progressive they have given us, has, as a rule, been devoted to the design and construction of the hull. In this respect, we must acknowledge their energy and clear sightedness and their success beyond cavil. But while beyond reproach on the one hand, they have laid themselves open on the other, to the charge of neglecting the internal for the external, and it is this charge which I purpose making definite, on one point at least, in a spirit of friendly criticism, to the end that they and we may both be benefitted.

It would seem as though the actual fighting qualities of the ship should alone be permitted to take precedence over that most essential requisite—a sound practical hygiene; and yet I fear this is often forgotten. To secure this requisite, there are needed a multitude of minor conditions and a few all-important ones. The latter will be largely fulfilled in a clean, dry, well ventilated ship.

By a clean ship I mean something wider in its scope than spotless decks and ladders, fresh paint and glistening bright work. I pass these by as admirable desiderata which, however, scarcely touch the objec-

tive—hygiene—and I ask "Is the air pure? and are the bilges clean and dry from stem to stern?" How often the answer comes "They are carefully cleaned every week *wherever they can be gotten at.*" That every inch of the bilge is not readily accessible is most certainly the fault of the constructor; and that fault is very grave.

To begin with, the fore peak, in even the smallest ships, should be high enough between the store-room deck and the keelson to permit a man to enter and to reach every part more or less freely. This, by the way, is a general rule applicable to all bilges.

Abaft this in our smaller sloops is the collision bulkhead. It should, like every water tight bulkhead, be provided with bilge water gates worked from the berth deck.

Next, in the same class of ships, come the fore passage, with sail rooms and store rooms on either side, and the fore hold. In the former are stowed, under a flying deck, coils of spare rigging, cordage, et cet., that rest on a dunnage floor; in the latter, the wet provisions et cet. I have always found this floor, in both hold and passage, of heavy plank, fitting tightly and *spiked down.* Possibly there may be one pair of scuttles in the whole length of the passage, and another pair in the hold. Ten chances to one, the space under the floor is too small to admit a man to scrape and whitewash. The consequence is, that the bilge is only cleaned in the immediate neighborhood of the scuttles, leaving the dirt elsewhere to undisturbed evolution of poisonous gases which superinduce ship fever and erysipelas and a low sanitary state of the ship's company; and which account but too well for the stubborn resistance to medical treatment and the long tedious convalescence noticed on board certain of our men-of-war.

I say without qualification that this arrangement is dangerously wrong and that we should not hesitate to rip up the planks that protect this vicious process, placing in their stead a series of scuttles fitting neatly enough to keep dirt from falling through, yet freely enough to lift up without trouble.

In the design of every ship this point should be carefully attended to and the dunnage floor fitted with scuttles and raised high enough to admit a man for cleaning purposes. If this is not practicable the only resource is to alternate scuttles and solid planks the whole length of the dunnage floor.

These scuttles and a high bilge become of the utmost importance in cleaning under water tanks, chain lockers and coal bunkers. A little forethought in building the ship will save much hard labor to those

destined afterwards to live in her, for water tanks are awkward things to move, and lifting one hundred and twenty or more fathoms of chain soon grows monotonous. Even in the chain lockers, with too low a bilge, provision is never made for getting underneath the floor.

In lockers and bunkers a simple scuttle would not answer, the weight above is too great. As a substitute, one plank might be laid in loosely, its ends resting upon the main and bilge keelsons. Should the working through of dirt or coal dust be apprehended, nail battens over the seams and butts. These can be taken off when desired and the plank raised without trouble.

I have often found a collection of pipes from the deck pumps and the boilers at the forward end of the fire room which so blocked up the bilge that a man could not pass under a bunker forward, and even that crude method of cleaning the bilge—the use of a force pump—had to be abandoned. It is needless to state that a more open arrangement should be made.

To the fire room, engine-room and shaft alley bilges, little objection on the score of design can be urged. I could suggest the insertion of dams with movable water gates into the bilges, both forward and abaft the engines, to prevent the oil dripping from the machinery from spreading into the forward bilges. The presence of oil in the bilges, is of course to be particularly avoided. These after bilges, as a rule, are so open and accessible, that their normal state should be that of purity—and a foul fire-room bilge a very rare exception.

To conclude these remarks upon the construction of bilges; I hold, first, that generally speaking, the bilges are not accessible when the ship goes into commission; secondly, that they should be accessible; thirdly, that the constructor is to blame for their not being accessible, and finally I cannot exempt this officer from a full share of responsibility for the fatal effects on board our ships of bilges not in their entire length scrupulously, absolutely clean.

II

It is but just to confess our own neglect as naval officers in the matter of keeping bilges in good order, for I am by no means sure that everything is done that can be done. In this, *thoroughness* should be regarded as an imperative duty, for carelessness will certainly defeat us.

Fonssagrives, (I think) says that it is the water *inside* of a ship that kills sailors, *not* that *outside*. Accepting the dictum of this high authority I would suggest that, when it can be avoided, *washing out the*

bilges, be never resorted to. The dirt should be scraped up, any water found there wiped up carefully with swabs or oakum, and all the surfaces covered, not too thickly, with whitewash, sulphate of iron, or other disinfectant applied with a brush. After this, the scuttles should be kept open as long as possible, to permit the exit of foul air and the drying of the moisture.

The ship should be pumped out morning and evening, if the water in the well be above the "sucking" point—to keep the bilges as dry as practicable.

The water gates in the different bulkheads should be kept up, in port, and the fore peak open, so that a current of air, however feeble, may circulate through the bilge from forward aft. To some, this may appear a very slender reed, but until a much needed revolution in the ventilating of our ships takes place we must do this, the little in our power.

At sea these water gates should be closed. If open, the water tight bulkheads are rendered useless, and in the event of accident, the gates might be forgotten. A still more cogent reason is that through them the fine dirt and coal dust which unavoidably sifts into the bilge, from the fire room, gradually work their way forward, acted upon by the water in the bilge set in motion by the pitching of the ship. By itself, this dirt would do little harm, but it takes with it oil and grease from the engine, absorbed into its pores, and these are fecund generators of noxious vapors. This is no fancy; I have known a steamer's forward bilges in a few months to accumulate stinking balls of mud, coal dust and grease, larger than a man's head, and every particle came through a small gate in a water-tight bulkhead.

Last but not least, bilges should be cleaned frequently as well as thoroughly.

Accept the fact that the task is disagreeable and troublesome, but, notwithstanding, make every week, a vigorous attack on this hidden dirt—you will find your reward in unstained paintwork, a small sick list in all climates, and a robust crew.

Lieut. J. F. Meigs, U. S. N. I have made experiments in company with Dr. Howard Smith U. S. N., and have found sufficient carbonic acid on the berth deck of the "Omaha," to be exceedingly poisonous, especially in bad weather when the hatches were battened down; in which case I cannot see how the poisonous gas can escape. I found only eighty-nine cubic feet of air were allowed to each man.

Three thousand five hundred cubic feet are allowed in the Pennsylvania Hospital. I deem reform in ventilation advisable. I do not think that Lieut. Com. Goodrich quite goes to the root of the evil. I believe in forced ventilation. A long tube might be placed under the berth deck, with openings, through which air could be forced by an engine. I think the engine for this purpose could be run at a less expense than the galley stove. As an experiment I placed all the ingredients of bilge water in a bottle and after having kept it corked for some weeks could detect no unpleasant odor arising from it. I do not think that the trouble comes so much from the bilge water as from the confined air. I think that the automatic air pumps placed in some of our vessels are doing good, but there are not enough of them.

Chief Engineer Baker. I think that Mr. Meigs is right. I believe that the employment of power alone can produce sufficient ventilation. I think, however, that the expense would be great, the object is well worth the expense however. Several years ago experiments were made to ventilate the Senate chamber. The amount of power necessary was estimated at from twenty-five to seven hundred and fifty H. P. The power necessary to force a column of air from the top being seven hundred and fifty H. P. In a ship where each person gets eighty-nine instead of three thousand cubic feet the process would be very heavy. I doubt whether ship ventilation will ever be successful until mechanical means are used. As to the expense, if a nation intends to have a navy it must pay for it. There is no use of having improved ships, guns and machinery if the men are not in good condition.

Commander Sampson, U. S. N. I think that there is no doubt of the necessity of proper ventilation, especially when the men are below. I think that the carbonic acid gas comes from the combustion going on in the men's bodies. The carbonated hydrogen from the bilge also affects the air. I think that Lieut. Com. Goodrich is right to a certain extent, but good ventilation will never be obtained until mechanical means of ventilation are used.

Rear Admiral C. R. P. Rodgers, U. S. N. I think that the paper deals with the neglect to make proper provision for cleanliness, which must greatly affect the ventilation, in a very thorough way. I think that the lecturer has gone very much to the inner matter. I think that the constructors are to blame for not making proper provisions to get at the bilges. Mechanics are careless and leave much dirt in the bilges. Cold chisels, clothes and all manner of things are found in the bilges.

These things become particularly obnoxious in the West Indies. In English ships the bilges are always as accessible as the cabin of the commanding officer. No man, who has been first lieutenant of a ship, will not say that it is almost impossible to get at the ships bilges. I think that the paper is most excellent. When I was first lieutenant of the "*Wabash*," I had to crawl on my hands and knees, and even then could not reach many places which were indeed inaccessible and could never be cleaned. The old idea of letting in water to the bilges is bad on account of the foreign substances admitted with the water which combine or deposit. Care should be taken in using disinfectants which themselves often become obnoxious.

LIEUT. COMMANDER A. D. BROWN U. S. N. In one ship to which I was attached we could not reach the bilges, beyond the engines and boilers. The flooring of the shaft-alley was spiked down. The floors of the shell rooms and store rooms came so close to the keelson, that I could hardly get my hand between them. We ran *hot* water from the donkey boiler into the bilges, and then pumped the ship out immediately, wiping up wherever it was possible, with good results.

PROF. MONROE U. S. N. I have listened to the paper with a great deal of interest. I am unacquainted with the subject except in a general sense. The sea water in contact with the wood generates hydrogen sulphides. I think that Mr. Meigs' experiment was unsuccessful because there was no air in contact with the water in the bottle. These gases are highly deleterious, having been known to produce instantaneous death. I think that it is highly important to have the bilges accessible, also to cover them with metalic paint, to prevent the water from coming in contact with the wood. The decomposition of oily, fatty matter is still more productive of evil.

REAR ADMIRAL ROGERS. We use in the Service several metalic disinfectants.

PROF. MUNROE. Those are not exactly what I referred to. When the water becomes acid in any way, they are again decomposed and the hydrogen sulphide is liberated in still larger quantities. If I understand Mr. Meigs correctly, he inferred that part of the carbonic acid gas came from the decomposition of the organic matter in the bilges. This is hardly possible, for, if carbonic acid is formed, then it would be consumed in decomposing the sulphates of the sea water. This has been proved experimentally by mixing soda water with sea water.

R. A. RODGERS. The system proposed by Lieut. Meigs and Chief Engineer Baker, is probably that now in use aboard the monitors. I

have no doubt but that at a very small expense, we might get a very good system. I think that it is surprising that men can exist in such foul air, as they do when a ship is battened down.

CHIEF ENGINEER BAKER. I think that the furnace fires help to carry off a good deal of the foul air.

LIEUT. MEIGS. The engine used to drive the fan at the Philadelphia Hospital is only six h. p. and burns 1 ton of coal a week; supply 1,000,000 cubic feet per hour. This force would not be necessary in a ship.

R. A. RODGERS. I think that a very small engine would do. The later monitors are probably better ventilated than any other ships of war.

CHIEF ENGINEER BAKER (to Mr. Meigs.) Does all the air which is supplied to the rooms in the Pennsylvania Hospital, come through this apparatus?

LIEUT. MEIGS. Most of it does.

P. ASST. ENGINEER CRAWFORD, U. S. N. The "*Nahant*" had two five h. p. blower engines which consumed 1,000 lbs of coal per day. The heat of the ship was not intense even when the hatches were closed. We never were troubled with bilge gases. In some of the ships they are covering the floors with cement.

At the conclusion of the discussion, a vote of thanks was tendered to Lieut. Commander Goodrich, for his very interesting paper.